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ASSESSING CLIMATE CHANGE IMPACTS ON FUTURE WATER AVAILABILITY AND DROUGHTS IN THE KENTUCKY RIVER BASIN

Somsubhra Chattopadhyay, Graduate Research Assistant
Dept. of Biosystems and Agricultural Engineering
University of Kentucky
234 C.E. Barnhart Building
Lexington, KY 40546
Phone: (859) 257-3000
Email: schattop14@uky.edu

Dwayne R. Edwards, Professor
Dept. of Biosystems and Agricultural Engineering
University of Kentucky
106 C.E. Barnhart Building
Lexington, KY 40546
Phone: (859) 257-5657
Email: dwayne.edwards@uky.edu

Global climate change is anticipated to raise a variety of challenges to water resources management. This study evaluated the potential impacts of climate change on hydrologic processes and droughts over the Kentucky River basin using the Soil and Water Assessment Tool (SWAT) watershed model. The SWAT model was successfully calibrated and validated then executed with forecasted precipitation and temperature outputs from a suite of Coupled Model Intercomparison Project Phase 5 (CMIP5) global climate models (GCMs) corresponding to two different representative concentration pathways (RCP 4.5 and 8.5) for two distinct time periods; 2036-2065 (mid-century) and 2070-2099 (late-century). Climate projections indicate modest increases in average annual precipitation and temperature in the future relative to the baseline (1976-2005) period. Monthly variations of water yield and surface runoff demonstrate increasing trends in spring and fall, while winter months are projected as having decreasing trends. Evapotranspiration (ET) displayed a consistent increasing trend in winter months, but a decreasing trend in summer months under all future scenarios. Spatial analysis indicated basin-wide increases in water yield and surface runoff, but to a lesser degree in the north-central portion. Meteorological and hydrological droughts were quantified using the Reconnaissance Drought Index (RDI) and Streamflow Drought Index (SDI). In general, maximum drought length is expected to increase, while drought intensity might decrease under future climatic conditions. Hydrological droughts, however, are predicted to be less intense but more persistent than meteorological droughts. Results of this study can be helpful in ensuring sustainable water resources in the Kentucky River Basin under changing climate as reflected by the GCMs.

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VARIANCE DECOMPOSITION OF MAXIMA EXTREME STREAMFLOW FORECASTED WITH GLOBAL CLIMATE MODELS

Nabil Al Aamery
Ph.D. Candidate
Department of Civil Engineering
University of Kentucky
354F O. H. Raymond Bldg.
Lexington, KY 40506-0281
Phone: (859) 536-1934
Email: nabil.hussain@uky.edu

Jimmy Fox
Professor
Department of Civil Engineering
University of Kentucky
354G O. H. Raymond Bldg.
Lexington, KY 40506-0281
Phone: (859) 257-8668
Email: james.fox@uky.edu

The concern of potential climate change impacts on flooding motivated the authors to investigate the net predicted change in future streamflow extremes and its variance for the wet region of southeast US. The authors recognized that differences in the prediction of maxima extremes (i.e., floods) within coupled climate-hydrologic modeling are possible based on the type of global climate model applied, the downscaling method, the project phase considered, the emission scenarios, the bias correction method applied, and the extremity probability analyses performed. Therefore, the specific objective of this contribution was to decompose the variance associated with the maxima extreme prediction from different factors, ranking the significant factors, and provide a balanced design for future maxima extreme predictions.

The research method coupled climate and hydrologic modeling for forecast and hindcast simulations and thereafter performed variance decomposition of modeling results. Publically available global circulation model results and the Soil Water Assessment Tool (SWAT) were used to predict streamflow for the South Elkhorn Watershed in central Kentucky, USA to 2050. The annual maxima and peak over threshold series were extracted from 113 SWAT model runs, and each series was then fitted to probability density functions. Three return periods, including 2-year, 20-year, and 100-year, were calculated for the forecast and hindcast periods in order to predict the percent difference in the extreme streamflows. A number of analysis of variance models were then carried out to identify and rank the contribution of each climate modeling factor to the variance of maxima extremes.

Variance decomposition results indicate that the prediction of the percent change in maxima extremes is a function of a number of factors ranked in order of importance as global circulation model type, downscaling approach, climate model project phase, bias implementation, and emission scenario. Surprisingly to the authors, the percent change in maxima extreme is not dependent on the extreme series type. In addition, our results suggest an average increase in the return levels of 2-year, 20- year, and 100-year return periods by 25(±19) %, 36(±40) % and 49(±81) %, respectively, for the future period 2050 as compared to the hindcast period. We suggest that the prediction of maxima extreme can provide a kernel for considering the non-stationarity in the prediction of maxima extremes across regions.

AQUAVIT: A HUBZERO-BASED COLLABORATION PORTAL FOR THE AFI AND SENSE PROJECTS

Jack Smith, Justin Chapman

Marshall University
One John Marshall Drive
Huntington, WV 25755
304-545-2759
Smith1106@marshall.edu
Chapman140@marshall.edu

In order to facilitate collaboration among water researchers in the Appalachian region, a web-based collaboration portal is being developed that is based on the HUBzero™ framework, which was developed at Purdue University and continues to be developed and supported through the HUBzero™ Foundation.

This portal is called *Aquavit* and is currently hosted at Marshall University, but it serves both the WV AFI (*Appalachian Freshwater Initiative*) and WV-KY SENSE (*Sensing and Educating the Nexus to Sustain Ecosystems*) projects, both multi-institutional projects funded by NSF EPSCoR.

This platform provides many traditional web-based tools to support collaboration, including: discussion forums, file sharing, group/project management tools, wiki pages, resource collections, etc. A particularly attractive and useful component is one that provides the ability for each user to have a private workspace (a Linux container) to develop, run, and share tools, as well as submit large computational jobs to remote resources.

This paper will provide an overview and brief live demonstration of the *Aquavit* portal, including some of the tools being implemented for watershed modeling, remote job submission, and a data portal for posting, sharing, and exchanging data with external sources.

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